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TECHNOLOGY TRANSFER OFFICE

Novel Class of Nanohybrids for Construction of Light Harvesting Systems

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Patent pending, available for licensing.

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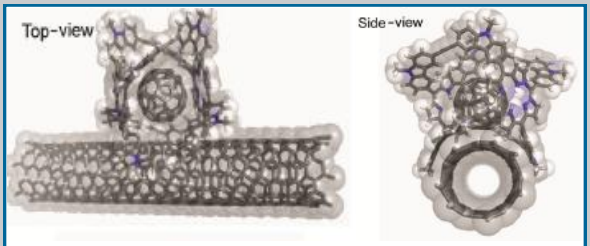
Background

Semiconducting single wall carbon nanotubes (SWCNTs) have unique electronic and optical properties for diverse optoelectronic applications, including photovoltaics, photodetectors and photoswitches. SWCNT-porphyrin molecular complexes are promising candidates for light harvesting applications, due to their long-lived charge separated states and efficient charge-transport behavior of SWCNTs. In the natural light-harvesting complexes, the electron transfer from the porphyrin pigment to the reaction center is triggered to drive photosynthesis. Sophisticated self-organization of the natural porphyrin photosystems serves as a model for artificial photosynthetic systems that require efficient energy and electron transfers. Accordingly, the synthesis and supramolecular self-assembly of a variety of porphyrin pigments have been widely explored with the aim of constructing efficient photochemical and optoelectronic devices. However, it is challenging and time-consuming to produce such complex supramolecules in a reasonable yield.

Technology

A University of Colorado research team led by Wei Zhang has developed a novel strategy *en route* to a new class of nanohybrids to overcome the challenges in construction of light harvesting systems. The team encapsulated C60 into a shape-persistent covalent organic polyhedron (COP) to afford C60@COP core-shell complexes. These complexes then bind to the surface of SWCNTs in a "side-to-face" fashion through π-π stacking interactions. The assembled C60@COP/SWCNT nanohybrids proved an integrative component for the construction of solar cell devices. By constructing a solar cell comprised of a spun-cast photoactive thin film of C60@COP/SWCNT, researchers found that the nanohybrid materials have great potential in photovoltaic applications. The results not only document the optoelectronic processes in the complex, but sketch a potent alternative for fabricating efficient photoactive molecular devices with this novel class of nanohybrid materials.



Energy minimized structures of the self-assembled SWCNT and C60@COP complex

Key Documents

"Nanohybrid Compositions Comprising Carbon Nanotubes and Covalent Organic Polyhedron-Fullerene Complexes." Provisional patent application filed March 2013; available under CDA.

"Nanohybrid Solar Cells Consisting of Self-Assembled Semiconducting Single-Wall Carbon Nanotube and Covalent Organic Polyhedron(COP)- C60 Core-Shell Complexes." Manuscript in preparation; available under CDA.

Semiconducting Carbon Nanotube and Covalent Organic Polyhedron–C60 Nanohybrids for Light Harvesting. Chem. Commun., 2012, 48, 8377–8379. *PDF available upon request.*